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Masaharu Nagai

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EXAMINER

CHACKO DAVIS, DABORAH

ART UNIT

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1795

MAIL DATE

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/694,986	Applicant(s) NAGAI ET AL.	
	Examiner DABORAH CHACKO DAVIS	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 January 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11, 17, 18 and 20-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11, 17-18, 20-35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-4, 9-11, 20-27, and 32-35, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 4,646,424 (Parks et al., hereinafter referred to as Parks) in view of U. S. Patent No. 6,009,888 (Ye et al., hereinafter referred to as Ye) and U. S. Patent No. 5,252,427 (Bauer et al., hereinafter referred to as Bauer).

Parks, in col 2, lines 59-68, in col 3, lines 1-10, in col 6, lines 3-59, discloses a method of forming a semiconductor device by forming a gate electrode on a substrate, forming a positive resist pattern (the resist is photosensitive, contains a photosensitizer) on the gate material film (metal layer), plasma etching (dry etching) the gate material film exposed using the resist pattern as the mask, removing the remaining resist material (after etching the metal i.e., titanium) by using a stripper (stripping the remaining resist, resist removing process, a resist stripper dissolves and removes the remaining resist) (claims 1-4). Parks, in col 1, lines 8-11, and in col 2, lines 59-65, discloses that the metal film is a titanium film and the titanium forms a gate electrode material in a thin film transistor (claims 9-11, and 24-27). Parks, in col 6, lines 5-7, discloses that the substrate material is glass (claims 20-23).

The difference between the claims and Parks is that Parks does not disclose irradiating the resist residuals as recited in the claims, remaining on the pattern after the stripping process, with light. Parks does not disclose that after the dry etch processes (more than one dry etch process) the resist pattern is irradiated with light. Parks does not disclose that that light irradiated has multiple wavelengths as recited in claims 32-35. Parks does not disclose that the irradiated residue of the resist pattern is removed using a developer.

Ye, in the abstract, and in col 5, lines 1-67, and in col 6, lines 1-35, discloses that after the dry etching processes and resist stripping processes, an irradiation is performed on the resist pattern and/or the resist residue that will inherently cause a reaction in the photosensitizer present in the resist pattern (photoresist or resist material has a photosensitizer) remaining on the pattern structure formed (metal or insulating patterns), with laser. Ye, in col 5, lines 51-55, discloses that the photoresist pattern is irradiated with a UV in the claimed range.

The difference between the claims Parks in view of Ye is that Parks in view of Ye does not disclose that the irradiated residue of the resist pattern is removed using a developer.

Bauer, in col 6, lines 54-68, discloses that the remains of the resist pattern is further irradiated and removed using a developer.

Therefore, it would be obvious to a skilled artisan to modify Parks by employing the method of irradiating the resist pattern after dry etch processes using wavelengths in the claimed range, and/or stripping processes as suggested by Ye because Ye, in col

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4, lines 33-34, discloses that irradiating the residues remaining or photoresist pattern (remaining after dry etch processes) with laser is a synergetic effect that is superior to conventional strip processes, and Ye, in col 5, lines 51-57, discloses that irradiating the photoresist pattern in the claimed range of wavelengths result in the partial removal of the polymer and the photoresist without damaging the underlying layers or substrate, and Ye, in col 6, lines 25-26, discloses that laser removes all the polymers and resist remaining on the structure. It would be obvious to a skilled artisan to modify Parks in view of Ye by employing a developer to remove the irradiated residue as suggested by Bauer because Ye, in the abstract, teaches irradiating the resist remains and removing the irradiated residue in a solution, and Bauer, in col 7, lines 1-5, discloses that either a stripper solution or an overall exposure (blanket exposure) followed by developer removal of solubilized areas (exposed residues) can be implemented for removal of resist remains.

3. Claims 5-8, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 4,646,424 (Parks et al., hereinafter referred to as Parks) in view of U. S. Patent No. 6,009,888 (Ye et al., hereinafter referred to as Ye) and U. S. Patent No. 5,252,427 (Bauer et al., hereinafter referred to as Bauer) as applied to claims 1-4, 9-11, and 20-27 above, and further in view of U. S. Patent No. 6,645,851 (Ho et al., hereinafter referred to as Ho).

Parks in view of Ye and Bauer is discussed in paragraph no. 2.

The difference between the claims and Parks in view of Ye and Bauer is that Parks in view of Ye and Bauer does not disclose the photosensitizer recited in claims 5-8.

Ho, in the abstract, and in col 4, lines 1-19, discloses that the photoresist composition used for forming the photoresist pattern mask is a novolac type resin that includes a photosensitizer such as diazonaphthoquinone compound.

Therefore, it would be obvious to a skilled artisan to modify Parks in view of Ye by employing the photoactive compound (photosensitizer) suggested by Ho in the photoresist composition because Ho, in col 9, lines 43-54, discloses that adding the claimed photosensitizer (DNQ) in the photoresist composition enables the use of the formed photoresist composition (novolac resin + DNQ) in wavelengths such as 300nm to about 500nm, and also aids in the lowering of the melt temperature of the formed photoresist layer below the glass transition temperature of the novolac resin.

4. Claims 17-18, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 4,646,424 (Parks et al., hereinafter referred to as Parks) in view of U. S. Patent No. 6,009,888 (Ye et al., hereinafter referred to as Ye) and U. S. Patent No. 5,252,427 (Bauer et al., hereinafter referred to as Bauer) as applied to claims 1-4, 9-11, and 20-27 above, and further in view of U. S. Patent No. 4,816,115 (Hörner et al., hereinafter referred to as Hörner).

Parks in view of Ye is discussed in paragraph no. 2.

The difference between the claims and Parks in view of Ye and Bauer is that Parks in view of Ye and Bauer does not disclose the exposure period of time recited in claims 17, and 18.

Hörner, in col 5, lines 25-30, discloses that the photoresist is exposed to radiation for about 3 seconds.

Therefore, it would be obvious to a skilled artisan to modify Parks in view of Ye and Bauer by employing the exposure range suggested by Hörner because Hörner, in col 5, lines 30-52, discloses that adjusting the exposure time to a desired duration enables the tailoring of the desired edge angle of the photoresist pattern formed.

5. Claims 28-31, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 4,646,424 (Parks et al., hereinafter referred to as Parks) in view of U. S. Patent No. 6,009,888 (Ye et al., hereinafter referred to as Ye) and U. S. Patent No. 5,252,427 (Bauer et al., hereinafter referred to as Bauer) as applied to claims 1-4, 9-11, and 20-27 above, and further in view of U. S. Patent No. 4,673,808 (Katohno et al., hereinafter referred to as Katohno).

Parks in view of Ye and Bauer is discussed in paragraph no. 2.

The difference between the claims and Parks in view of Ye and Bauer is that Parks in view of Ye and Bauer does not disclose that the resist stripper has a mixture of 2-aminoethanol and a glycol ether (claims 28-31).

Katohno, in col 5, lines 20-28, and lines 65-67, discloses the use of a Nagase stripper solution (Nagase N-series stripper solution is blend of aminoethanol and glycol ether) to remove the remaining resist pattern (after etch processes).

Therefore, it would be obvious to a skilled artisan to modify Parks in view of Ye and Bauer by employing the stripper solution suggested by Katohno because Parks in col 6, lines 55-59, teaches using a resist stripper to remove the remaining resist material and Katohno, in col 5, lines 1-30, discloses that using the claimed resist stripper (Nagase stripper solution) enables the removal of the resist by releasing thus avoiding the presence of the residual portions of the resist pattern on the metal plate to be patterned.

Response to Arguments

6. Applicant's arguments filed January 22, 2008, have been fully considered but they are not persuasive. The 103 rejections made in the previous office action (paper no. 20070917) are maintained.

A) Applicants argue that neither Parks nor Ye teaches the removal of the resist pattern with a resist stripper.

Ye is not depended upon to disclose the use of a resist stripper to remove the resist pattern. Parks, in col 6, lines 58-60, teaches using a resist stripper to remove the remaining resist material from the substrate.

below. Finally, in the process of the present invention, a remaining resist material is stripped from the substrate.

The cited portion above indicates that the remaining resist i.e., the resist residue of the resist pattern is stripped. Stripping of resist is accomplished by using a resist stripper.

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B) Applicants argue that neither nor Ye teach irradiation of a residue of a resist pattern with a light after removing the resist pattern and removing the residue of the resist pattern with a developer that dissolves and removes the residue of the resist pattern

Parks teaches using a resist stripper to remove the remaining resist material (resist pattern after etching the gate material or titanium). Parks is not relied upon to disclose the irradiation and developer use performed after the stripping process. Ye, in col 2, lines 34-44, discloses that the residue of the photoresist and polymer is removed by irradiation and immersion in an oxidant. Ye, in col 5, lines 1-57, is relied upon to disclose the removal of the polymer residue of the photoresist after the etch processes, wherein the residue is removed by UV irradiation and the immersing of the treated substrate in an oxidizing bath. Bauer is depended upon to disclose the use of developer to remove irradiated resist residue. See paragraph no. 2 above.

C) Applicants argue that Ye does not disclose that the removal of the resist pattern residue is after irradiating the residue of the resist pattern.

Ye, in col 7, lines 18-36, discloses that the stripping tool that employs the stripping solution (acid bath) does not strip the residue (polymer and photoresist remains after etching and processes) by itself, but requires that the UV laser is used to irradiate the polymer and photoresist residues in order to be removed after which the acid bath proceeds in the stripping action i.e., the residues are not removed by the stripping solution at first because they have to be irradiated with the laser in order for

the stripping process to proceed. Therefore, the process of Ye teaches irradiating the residue of the photoresist followed by their removal.

D) Applicants argue that Bauer does not disclose irradiating the residue and removing the irradiated residue with a developer.

Bauer is not depended upon to disclose irradiating a resist residue. Bauer is relied upon to disclose the use of a developer after irradiation of a resist remaining on the device.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daborah Chacko-Davis whose telephone number is (571) 272-1380. The examiner can normally be reached on M-F 9:30 - 6:00. If attempts to reach the examiner by telephone are unsuccessful, the examiner's

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supervisor, Mark F Huff can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/John A. McPherson/
Primary Examiner, Art Unit 1795

dcd

/Daborah Chacko-Davis/
Examiner, Art Unit 1795

May 26, 2008